DETERMINING CROPPING SYSTEM AND TOPSOIL DEPTH EFFECTS ON PHOSPHORUS AND POTASSIUM NUTRIENT DYNAMICS

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ABSTRACT

Understanding the effects of fertilizer addition and crop removal on long-term change in soil test phosphorus (STP) and soil test potassium (STK) is crucial for maximizing the use of grower inputs on claypan soils. Due to variable topsoil depth, nutrient supply from subsoils, and crop removal across fields, accurate P and K fertilizer management can be challenging. Current Missouri fertilizer recommendations rely on a single buffering capacity for all soils throughout the state for P, and are only modified by cation exchange capacity for K. The objective of this research was to evaluate the effect of depth to claypan (DTC) and cropping system (annual grain v. perennial grass) on soil P and K buffering capacity. Research was conducted at the University of Missouri's South Farm Research Center in Columbia, MO from 2009 to 2015. Soil samples were collected to 6 inches in the spring of 2009 and University of Missouri recommended P and K fertilizer rates were applied to bring STP to 45 lb P_2O_5/ac and STK to 220 lb K_2O/ac. During 2010 to 2014, no fertilizer was applied and corn (*Zea Mays* L.), soybean (*Glycine max* [L.]), and switchgrass (*Panicum virgatum* L.) P and K removal were measured. Soils were again sampled to 6 inches and to 36 inches in the spring of 2015. Data were compared using a nutrient buffering index that accounted for soil test change (top 6 inches of soil), crop removal (harvested portion of plant only), and fertilizer additions. Each input into the buffering index calculation was analyzed independently. Results showed that cropping system significantly affected nutrient removal, but not soil test change. Depth-to-claypan affected P and K removal and the change in STP. With each 1 inch increase in DTC, P and K removal increased 0.55 and 2.48 lb K_2O /ac, respectively, and change in STP decreased 5%. Soil test P and STK to a depth of 36 inches showed that shallow DTC resulted in higher subsoil P and K levels. Estimates for subsoil P levels were 40 and 13 lb P_2O_5/ac for shallow and deep topsoils, respectively, while K levels were 352 and 210 lb K_2O /ac. Therefore, adjusting Missouri's current P and K fertilizer rate calculations to account for DTC should result in improved fertilizer recommendations.

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